Temporal and Spatial Pattern Evolution and Influencing Factors of Ecological Civilization Construction in the Yangtze River Economic Belt

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Abstract. Measuring the quality of ecological civilization construction in the Yangtze River Economic Belt provides guiding suggestions for the green development of the region. This article uses the entropy weight method and fixed effects model to study the temporal and spatial evolution characteristics of the development of ecological civilization construction in the Yangtze River Economic Belt and its three major river basins from 2005 to 2020 and key influencing factors. Research results: Firstly, from 2005 to 2020, the overall quality of ecological civilization construction had maintained a continuous upward trend, and the development level of the upstream region was in a leading position. Secondly, the development advantages of ecological economy and environmental protection were prominent, and the development speed of the mid-stream region was relatively slow. Thirdly, in the analysis of spatial evolution characteristics, there were significant differences in the development levels of provinces and cities in different regions, with higher fluctuations in the development of upstream region. Fourthly, in the analysis of influencing factors, the investment factor had a significant positive impact on ecological civilization development, government intervention and infrastructure promoted the ecological civilization development, while urbanization had an inhibitory effect on it. Research suggestions: In response to the current situation of ecological civilization construction in the Yangtze River Economic Belt, various regions should strengthen coordinated development, balance development in all dimensions, adopt a regional ecological civilization development strategy adapting to local conditions, coordinate economic and ecological development, and improve the environmental protection regulatory system.

Keywords: Yangtze River Economic Belt; Ecological Civilization Construction; Entropy Weight Method; Fixed Effects Model.

1. Introduction

Ecological Civilization Construction is an important part of the cause of socialism with Chinese characteristics. Accelerating ecological civilization construction requires not only the efficient leadership of the Party Central Committee and governments at all levels, but also the active response and high degree of cooperation from national people. Under the guidance of the idea of ecological civilization put forward by Xi Jinping, it is essential to implement the "green" development concept to promote green production modes, green lifestyles, green ecological values and build a green ecological system. As one of the most influential economic regions in China, the Yangtze River Economic Belt also occupies a prominent ecological position, which is an important area that China attached importance to and cultivates in ecological civilization construction projects. With the economic development of nine provinces and two cities along the Yangtze River Economic Belt, the utilization of resources and the protection of the ecological environment will be limited. Therefore, in-depth research on the quality of ecological civilization construction in the Yangtze River Economic Belt, analysis of its influencing factors, and formulation of solutions are the primary tasks to promote the ecological civilization construction in the Yangtze River Economic Belt.

There are few studies on the concept of "ecological civilization" from foreign scholars, while most studies focus on theoretical research on "sustainable development" and related research on the relationship between society, economy and ecology. In 1898, Howard [1] proposed the "Garden City Theory", which leads the issue of coordination and development between social urbanization and ecology. Literature such as "Silent Spring" (1962), "Survival Blueprint" (1972), and "Limits to

Growth" (1972) reveal the negative impact of urbanization and economic development on the ecological environment. The concept of sustainable economic development proposed by Edward B [2] in 1987 believes that the overall goal should be to maximize the interaction of the biological and resource system, the economic system and the social system, and "sustainability" must be adapted to all forms of economic and social activities. In addition to the research on theories related to sustainable development and ecological civilization construction, the existing domestic literature mainly focus on the research on "the coupling coordination relationship between urbanization, industrial adjustment and ecological civilization construction" and "the development of ecological efficiency of various industries in the Yangtze River Economic Belt". Deng Zongbing et al. [3] used the coupling coordination degree model to analyze the coordination between ecological civilization construction and new urbanization in the Yangtze River Economic Belt, Bi Guohua et al. [4] used provincial panel data to analyze the coupling coordination relationship between ecological civilization construction and urbanization in China, and Huang Cheng et al. [5] studied the synergy between industrial green transformation and ecological civilization construction in the Yangtze River Economic Belt. Most studies also used SBM model, Global Moran's I Index, Tobit model, and panel regression model to measure the ecological efficiency of industry, agriculture, tourism and other industries in the Yangtze River Economic Belt, as well as explore the temporal and spatial evolution characteristics and influencing factors [6-8].

In summary, although the existing literature have been relatively rich in researching on ecological thought theory and the relationship between industries and the ecology, it lacks an overall grasp of the temporal and spatial evolution characteristics of the quality of ecological civilization and a discussion of its influencing factors.

2. Research Methods and Data Sources

2.1 Indicator System Construction

Table 1. Quality Evaluation Indicator System for Ecological Civilization Construction in the Yangtze River Economic Belt

Overall Indicator	Dimensional Indicators	Sub Indicators	Basic Indicators	Attribute	Weight
The Quality of Ecological Civilization Construction in the Yangtze River Economic Belt	The Optimization of Land Spatial Development Pattern	Living Space	Park Green Area Per Capita (Square Meters)	+	0.0718
			Greening coverage area (Hectare)	+	0.0793
		Ecological Space	Percentage of Forest Cover(%)	+	0.0898
	Ecological Economy	Green Industry	Total Emissions of Industrial Wastewater(10000 Tons)	-	0.0469
			Total Emission of Industrial Sulfur Dioxide (Ton)	-	0.0538
		Ecological Agriculture	Fertilizer Application Amount (10000 Tons)	-	0.1193
			Pesticide Usage Amount(Ton)	-	0.1040
	Ecological Environment Protection	Protection and Restoration of Natural Ecosystem	Total Afforestation Area (Hectare)	+	0.1021
		Pollution Prevention	Total Investment in Urban Environmental Governance Infrastructure (100 Million Yuan)	+	0.0759
			Urban Sewage Treatment Rate (%)	+	0.0540

			Harmless Treatment Rate of Domestic Garbage (%)	+	0.0422
	Resource Conservation and Consumption	Resource Conservation	Water Consumption Saving (10000 Cubic Meters)	+	0.0372
		Resource Consumption	Daily Domestic Water Consumption Per Capita (Liter)	-	0.0415
			Energy Consumption (10000 Tons of Standard Coal)	-	0.0457
			Electric Power Consumption (100 Million kWh)	-	0.0366

Note: "+" indicates a positive indicator, and "-" indicates a negative indicator.

The important theory of socialist ecological civilization construction in the new era proposed by Xi Jinping includes "six core connotation development concepts" which are the scientific outlook on nature, the green development concept, the ecological livelihood concept, the ecosystem concept, and the world win-win concept. This provides an important theoretical basis for various provinces and cities to accelerate the practical pace of ecological civilization construction [9]. Based on the guiding ideology and major objectives proposed in the "Opinions of the Central Committee of the Communist Party of China and the State Council on Accelerating the Construction of Ecological Civilization" and in combination with the practical difficulties faced by the construction of ecological civilization, the indicator system for the quality of ecological civilization construction in the Yangtze River Economic Belt is constructed from five dimensions: optimization of land spatial development pattern, ecological economy, ecological environmental protection, and resource conservation and consumption (Table 1). Land is the spatial carrier of ecological civilization construction, and the rational layout and management of living space, production space and ecological space is the main content of optimizing the spatial development pattern of land. Green economy, namely the green transformation of industrial structure, is the key content of accelerating the ecological civilization construction; therefore, developing green industry and ecological agriculture are the two essential measures to assault fortified positions. A good ecological environment is the most inclusive well-being of people, represented in the protection and restoration of natural ecosystem, pollution prevention and positive response to climate change. Most of the resources and energy needed for livelihood are derived from nature; as a result, resource conservation and rational utilization of energy are important processes in promoting the construction of ecological civilization.

2.2 Research Method

For the indicator weight assignment of ecological civilization construction in the Yangtze River Economic Belt, the article uses the entropy weight method to determine the weight of the indicator data. The assumption is that there are m samples of provinces and n evaluation indicators, and x_{ij} represents the value of the jth indicator in the ith province.

2.2.1 Dimensionless Processing of Indicators

Due to the 15 indicators from 4 dimensions included in the indicator system for the quality of ecological civilization construction in the Yangtze River Economic Belt and the inconsistency of the measurement units of each indicator, dimensionless processing of the data is required to avoid the impact of different dimensions.

Positive indicator processing method:

$$\lambda_{ij} = \frac{x_{ij} - \min(x_{ij})}{\max(x_{ij}) - \min(x_{ij})} \quad (1)$$

Negative indicator processing method:

$$\lambda_{ij} = \frac{\max(x_{ij}) - x_{ij}}{\max(x_{ij}) - \min(x_{ij})} \quad (2)$$

The indicator matrix $(\lambda_{ij})_{mn}$ is composed of values obtained from formulas (1) and (2). Since the standardized indicator values will appear 0 value, it is meaningless to take the logarithm when calculating the entropy value. Therefore, it is necessary to perform coordinate translation of the indicator value, which α is the amplitude of translation , and take α value as 1, to finally obtain a new matrix $(\lambda'_{ij})_{mn}$.

2.2.2 Entropy Weight Method

Entropy weight method is an objective weighting method that reflects the ability of distinguishing indicators by determining the weight of each indicator in the sample, avoiding artificial bias caused by subjective weighting. In this article, entropy weight method is selected as a method to determine the weight of evaluation indicators of ecological civilization construction in the Yangtze River Economic Belt. The specific operation steps are as follows:

The first step is to calculate the weight p_{ij} of λ_{ij} (indicator values) in the indicator system of the quality of ecological civilization construction in the Yangtze River Economic Belt:

$$p_{ij} = \lambda'_{ij} / \sum_{i=1}^{m} \lambda'_{ij} \quad (3)$$

The second step is to calculate the entropy value of the jth indicator e_j:

$$e_j = -(\ln m)^{-1} \sum_{i=1}^{m} (p_{ij} \ln p_{ij}) \quad (4)$$

The third step is to calculate the comprehensive weight of the jth indicator w_j:

$$w_j = \frac{1 - e_j}{\sum_{i=1}^{m} (1 - e_j)} \quad (5)$$

$1 - e_j$ is the coefficient of difference of the jth indicator, which determines the importance of the indicator in the overall indicator system.

The fourth step is to calculate the comprehensive evaluation indicator W_{ij}:

$$W_{ij} = \sum_{i=1}^{n} w_j \lambda_{ij} \quad (6)$$

2.3 Data Source

The data used in this article are all from the "China Statistical Yearbook", "China Energy Statistical Yearbook", "China Environmental Statistical Yearbook", the EPS Global Statistical Data/Analysis Platform, and the statistical yearbooks of the nine provinces and two cities along the Yangtze River Economic Belt. The selected time span is from 2005 to 2020, and the missing data for individual years are supplemented through the "annual average growth rate" method.

3. Empirical Analysis

3.1 Temporal and Spatial Pattern Evolution of Ecological Civilization Construction in the Yangtze River Economic Belt

Since the proposal of "building a resource saving and environment friendly society" in the "The Eleventh Five Year Plan", the overall indicator value level of ecological civilization construction quality in the Yangtze River Economic Belt had steadily increased from 0.384 in 2006 to 0.601 in 2020, with an annual average growth rate of 3.27%. The ecological civilization construction of the upstream region had always been significantly ahead of that in the middle and downstream regions, which might benefit from the relatively low urbanization level and population density of the provinces in the upstream region, resulting in lower utilization of natural resources and less damage to the ecological environment; however, the development of this region fluctuated greatly, showing an overall fluctuating upward trend, which may be caused by the different pace of ecological civilization development and different conditions of economic development among provinces and cities in the

upstream region. There was a little difference in the level of ecological civilization development between the midstream and downstream regions, and during the period of the eleven years from 2005 to 2016, the quality indicator values of the downstream region led the midstream region. Since 2010, the development level of the midstream region had gradually moved closer to that of the downstream region, and after 2016, it had turned the tide, which indicates that the economic development advantages of the downstream region had not significantly promoted the development of ecological civilization construction, while the realization of ecological civilization construction development was more beneficial to the enforcement effectiveness of relevant policies in various regions and the reasonable utilization of ecological resources (Figure 1).

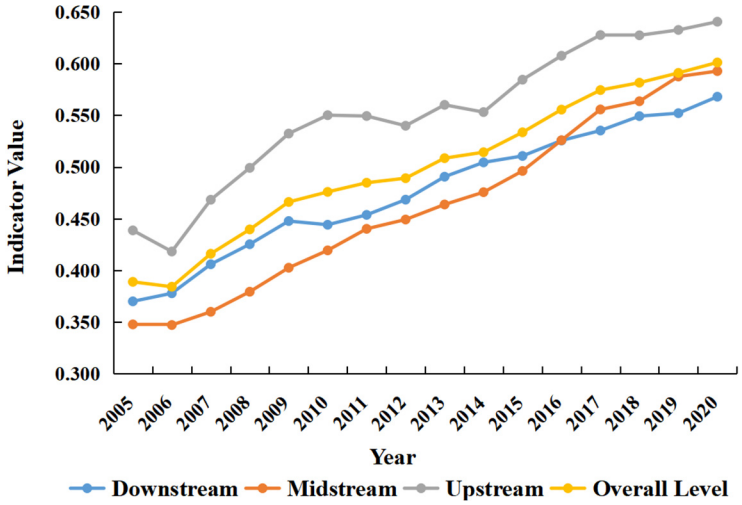

Figure 1. The Indicator Value of Ecological Civilization Construction in Three Major River Basins of the Yangtze River Economic Belt (2005-2020)

The development impetus for the ecological civilization construction in the Yangtze River Economic Belt mainly come from the sustainable development of the ecological economy, with an average annual value of about 2.03; ecological environment protection and optimization of land spatial development pattern were also the important components in promoting the construction of ecological civilization, with average annual values at about 1.37 and 1.15 respectively; while the indicator value of resource conservation and consumption was the lowest, with an average annual value of only about 0.95 (Table 2). The changes of indicator values of various dimensions in the Yangtze River Economic Belt and the three major river basins (Table 3) are as follows:

The development of optimizing land spatial development pattern had shown stable growth. The average annual growth rate of the evaluation value ranked second among the four dimensions, with an average annual growth rate of about 5.21%. The average value and average annual growth rate of the indicator values in the midstream region of the Yangtze River from 2005 to 2020 were both the minimum values at about 0.33 and 4.06% respectively. Among the three provinces in the midstream region, Jiangxi Province is rich in mountains and rivers and has a stable natural ecological environment; Hubei Province attached more importance to the ecological development of living space. However, compared to provinces and cities in other river basins, the region was lagging behind in terms of the ecological management of living space.

The achievement of ecological economy development was the most outstanding. The average evaluation value of ecological economy development in the Yangtze River Economic Belt was the largest at about 2.03, while the annual growth rate was not ideal at only about 1.59%. From a regional perspective, the downstream region had made the most prominent contributions to the implementation of green industry and ecological agriculture, which made it rank first in terms of annual average value and annual growth rate in the two fields. This might be related to the serious urbanization of the

downstream region, less agricultural land and the developed economy, and a good economic situation was undoubtedly the foundation for achieving green industry.

The protection of ecological environment was developing at the fastest speed, with the largest the average annual growth rate at about 7.67%, which indicated that the emphasis of government on ecological environmental protection was significantly increasing. From a regional perspective, the governments of the provinces and cities in the downstream region had laid a more solid foundation for ecological environment protection, with the highest average annual value at about 0.46. However, the developing rate of ecological environment protection in the downstream region was the lowest at about 6.12%; the main reason was the lack of protection and restoration of natural ecosystems, which might be caused by the rapid economic development and serious urbanization in the downstream region.

The development of resource conservation and consumption was at a disadvantage. Its average annual value is the smallest at approximately 0.95, and the average annual growth rate was negative at about -0.83%, which indicated that China attached little importance to resource conservation and rational utilization and lacked long-term planning. The key to achieving resource conservation and rational utilization of energy lay in the cultivation of the thoughts of ecological civilization, which is the key issue in long-term ecological governance. Among the three major regions, only the downstream region had a negative annual growth rate at about -2.30%, which indicated that the rapid economic development inevitably led to unreasonable utilization of resources and the high-density population also hid the issue of uneven civilized literacy.

Table 2. Temporal Evolution Characteristics of the Dimension Indicator of Ecological Civilization Construction in the Yangtze River Economic Belt

Year / Dimensions	2006	2008	2010	2012	2014	2016	2018	2020	Average Value (2005-2020)	Annual Growth Rate % (2005-2020)
Optimization of Land Spatial Development Pattern	0.72	0.85	1.06	1.17	1.28	1.34	1.44	1.51	1.15	5.21
Ecological Economy	1.92	1.90	1.88	1.87	1.93	2.13	2.31	2.47	2.03	1.59
The Protection of Ecological Environment	0.60	1.03	1.31	1.41	1.53	1.72	1.77	1.78	1.37	7.67
Resource Conservation and Consumption	0.99	1.06	0.99	0.94	0.93	0.93	0.88	0.85	0.95	-0.83

Table 3. Temporal Evolution Characteristics of the Dimension Indicators of the Three Major River Basins in the Yangtze River Economic Belt

	The Optimization of Land Spatial Development Pattern			Ecological Economy			The Protection of Ecological Environment			Resource Conservation and Consumption		
	Down	Mid	Up	Down	Mid	Up	Down	Mid	Up	Down	Mid	Up
Average Value	0.42	0.33	0.40	0.72	0.41	0.81	0.46	0.34	0.37	0.39	0.30	0.50
Annual Average Growth Rate%	5.01	4.06	6.56	2.30	0.52	0.80	6.12	11.23	8.11	-2.30	1.58	0.97

Note: ‘Down’ represents downstream region, ‘Mid’ represents midstream region, ‘Up’ represents upstream region.

3.2 Spatial Evolution Characteristics of Ecological Civilization Construction in the Yangtze River Economic Belt

The following is an analysis of the spatial evolution characteristics of the quality of ecological civilization construction in the eleven provinces and cities in the Yangtze River Economic Belt (Figure 2):

The overall level of ecological civilization construction quality in the downstream region was steadily rising, reflecting the stability and continuity of the implementation of relevant policies in three provinces and one city, and emphasizing the regional synergy of ecological civilization construction and development. From the perspective of each province, the indicator values of Shanghai and Zhejiang provinces had always led the average level of the downstream region and the other two provinces. The developing process of ecological civilization quality in Zhejiang Province from lagging behind to anti surpassing Shanghai Province might be caused by the overload of population density in Shanghai and the decline in the importance attached to the ecological civilization construction in the process of coordinated development in various aspects. In addition to some fluctuations in the indicator values of Anhui and Jiangsu provinces during the special period, the overall increase in the two provinces had converged.

The overall level of the ecological civilization construction quality indicator in the midstream had shown a significant and continuous increase, reflecting the high efficiency and effectiveness of the three provinces in developing ecological civilization construction and the relative perfection of relevant policy systems. From the perspective of each province, the indicator values of Jiangxi was significantly ahead of the average level of the midstream region and the other two provinces, which was due to the rich natural resources and large-scale ecological land used in Jiangxi Province, as well as the outstanding achievements in ecological governance such as the continuous optimization of ecological environment quality, the accelerated improvement of modern governance level and the remarkable effect of green transformation development. From 2005 to 2015, there was a lagging difference in the quality and development of ecological civilization construction in Hubei Province compared to Hunan Province. Since 2016, the difference had been narrowing and showing a significant trend of convergence.

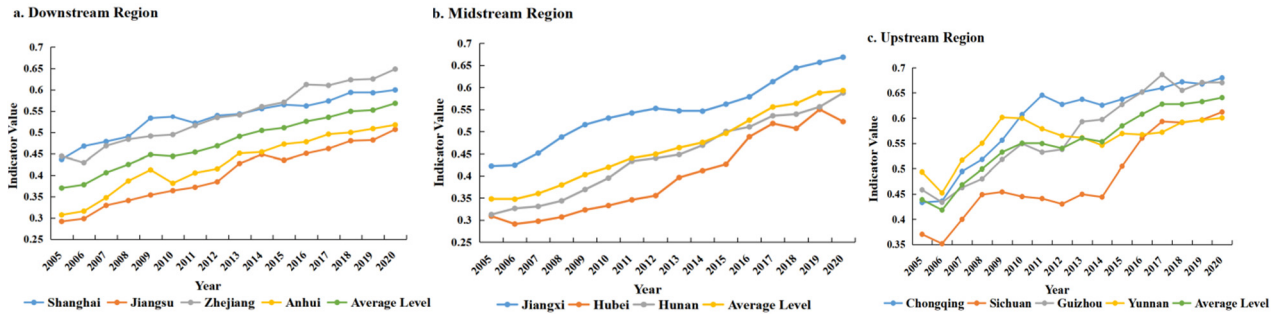

Figure 2. The Quality of Ecological Civilization Construction in the eleven Provinces and Cities of the Yangtze River Economic Belt (From 2005 to 2020)

There were significant differences in the quality of ecological civilization construction among the three provinces and one city in the upstream region, as well as the unstable development over the period of time, which might be caused by factors such as discontinuous policy implementation and unstable economic development related to ecological civilization construction. From the perspective of each province, except for Yunnan Province, the indicator values of the other two provinces and one city had shown a significant upward trend over the period of time. From 2006 to 2014, the ecological civilization construction in Yunnan Province had experienced significant increase and then decrease as the shape of "Inverted V", with the quality of ecological civilization experiencing a serious decline since 2010. The quality of ecological civilization construction in Sichuan Province had experienced a developing process from lagging behind to rapidly rising and maintaining stable improvement. The indicator values of Chongqing had always been higher than the average level in

the upstream region, but there had been a decline and deceleration development since 2011, which indicates that rapid economic development might have a certain degree of inhibitory effect on the improvement of ecological civilization construction.

3.3 The Study on the Factors Influencing the Temporal and Spatial Evolution of Ecological Civilization Construction in the Yangtze River Economic Belt

3.3.1 Model Construction

There are many factors influencing the temporal and spatial evolution of the development of ecological civilization construction. Based on the summary of existing theories and relevant discussions as well as the basic situation of ecological civilization construction at the current stage, the key factors can be summarized into four levels - the level of ecological material civilization, the level of ecological political civilization, the level of ecological spiritual civilization and the level of ecological social civilization[10]. This article selects the economic factor, infrastructure, urbanization, environmental regulation, investment, government intervention, and the trade factor as the seven influencing factors for the temporal and spatial evolution of ecological civilization construction in the Yangtze River Economic Belt (Table 4).

Table 4. Selection of Influencing Factor Indicators

Influencing Factor	Indicator Selection	Unit
Economic Factor	Gross Domestic Product Per Capita	Yuan
Investment	Proportion of Fixed Assets Investment to GDP	%
Government Invention	Proportion of Fiscal Expenditure to GDP	%
Urbanization	Proportion of Urban Population	%
Environmental Regulation	Proportion of Investment Completed to Industrial Pollution Control	%
Infrastructure	Traffic Density	Kilometers Per Square Kilometers
Trade Factor	Proportion of Total Import and Export to GDP	%

Based on the panel data of the 9 provinces and 2 cities in the Yangtze River Economic Belt, a multiple regression model of natural logarithm is constructed to study the impact of various factors on the temporal and spatial evolution of the quality of ecological civilization construction in the Yangtze River Economic Belt. The formula of the model is as follows:

$$\ln Y = \alpha + \beta_1 \ln GDP + \beta_2 \ln Invest + \beta_3 \ln GI + \beta_4 \ln Urban + \beta_5 \ln ER + \beta_6 \ln Trans + \beta_7 \ln Trade + \varepsilon$$

In the formula, Y measures the quality of ecological civilization construction in the Yangtze River Economic Belt using the indicators under the entropy weight method; ‘GDP’ represents the economic factor; ‘Invest’ represents investment; ‘GI’ represents government intervention; ‘Urban’ represents urbanization; ‘ER’ represents environmental regulation; ‘Trans’ represents infrastructure; ‘Trade’ represents the trade factor.

3.3.2 Empirical Testing and Result Analysis

Using Stata data analysis software and panel regression method for econometric testing, the results of the Hausman test confirms that a fixed effect model should be used. As time effects are added, a bidirectional fixed effect model is ultimately selected to construct. The results are shown in Table 5.

Based on the estimated parameters of each influencing factor in the table, it can be concluded that:

The coefficient of the economic factor (GDP) is positive, but it does not pass the significance test, indicating that economic growth was not obviously conducive to the development of ecological

civilization construction. The enhancement of economic strength provided a certain material foundation for the development of ecological civilization construction, but the influence was not significant, which indirectly indicates that the economic progress might rely on the consumption of resources and the destruction of some natural ecological environments.

Table 5. The Results of Fixed Effect Model Regression

Variables	Regression Coefficient	T Value	P Value
GDP	0.097	1.23	0.220
Invest	0.149**	2.44	0.016
GI	0.152*	1.90	0.060
Urban	-0.379**	-2.15	0.033
ER	-0.017	-1.50	0.136
Trans	0.098*	1.68	0.095
Trade	-0.028	-1.27	0.207

Note: *** represents the significance at the 1% level, ** represents the significance at the 5% level, and * represents the significance at the 10% level.

The coefficient of the investment factor (Invest) is positive and passes the significance test at the level of 5%, which indicates that the fixed asset investment of the provinces and cities of the Yangtze River Economic Belt in infrastructure, environmental protection and other projects in ecological civilization construction had significantly promoted the development of ecological civilization construction.

The coefficient of government intervention (GI) is positive and passes the significance test at the 10% level, indicating that government financial intervention had a positive impact on the ecological civilization construction. The larger the proportion of government fiscal expenditure (mainly purchasing expenditure) was, the greater the impact on economic production activities was, including the structural adjustment and scale expansion of ecological and environmental industry construction.

The coefficient of urbanization (Urban) is negative and passes the significance test at the 5% level, indicating that the proportion of urban population had a significant negative impact on the development of ecological civilization construction. The more severe urbanization was, the greater the urban population was, which directly led to ecological pollution and resource consumption issues and indirectly impacted on government investment decisions and agriculture development direction.

The coefficient of environmental regulation (ER) is negative, but it does not passed the significance test, which indicates that the implementation effect of environmental regulation in the Yangtze River Economic Belt was not ideal and had not effectively played a positive role in the construction of ecological civilization.

The coefficient of infrastructure (Trans) is positive and passes the significance test at the 10% level, which indicates that the improvement of transport infrastructure was an important factor affecting the development of ecological civilization construction. The improvement of the public transportation system was conducive to reducing carbon pollution emission, and the transportation of raw materials and products relied on the transportation network; therefore, a sound transportation system promoted the ecological industries development.

The coefficient of trade factor is negative, but it does not pass the significance test, indicating that international economic trade did not have a significant impact on the development of ecological civilization construction.

4. Conclusion and Recommendation

4.1 Conclusion

This article summarizes the guiding ideology of the "Opinions of the Central Committee of the Communist Party of China and the State Council on Accelerating the Construction of Ecological Civilization", and constructs an evaluation indicator system for the quality of ecological civilization

construction in the Yangtze River Economic Belt from four dimensions: optimization of land spatial development pattern, ecological economy, ecological environment protection, and resource conservation and consumption. The entropy weight method is used to measure the ecological civilization construction quality indicator of the nine provinces and two cities along the Yangtze River Economic Belt from 2005 to 2020, which analyzed the temporal and spatial evolution characteristics and influencing factors of the overall ecological civilization construction quality of the Yangtze River Economic Belt and its three major river basins. The research conclusions are as follows:

Firstly, the overall development of ecological civilization construction in the nine provinces and two cities along the Yangtze River Economic Belt had maintained a sustained and stable upward trend from 2005 to 2020. Among the three major river basins, the quality of ecological civilization construction in the upstream region had always led the other two regions, but its development process was highly volatile, indicating a lack of synergy in the development of ecological civilization among the provinces and cities.

Secondly, in the evaluation dimension of the quality of ecological civilization construction in the Yangtze River Economic Belt, the development of ecological economy was the key aspect. The development achievements in ecological environment protection were the most significant, while the status of resource conservation and consumption was severely lagging behind. From a regional perspective, except for the ecological economy, the midstream region had the lowest development rate in the dynamic development process of the other three dimensions.

Thirdly, in the spatial evolution process of ecological civilization construction quality, the ecological civilization quality of Shanghai and Zhejiang Province had always been higher than the average level of the downstream region, while Jiangsu Province was in a backward position; the quality of ecological civilization in Jiangxi Province far exceeded the average level in the midstream region, while Hubei Province lagged relatively behind the other two provinces; compared to the other two major regions, the fluctuation in the development of ecological civilization in the provinces and cities of the upstream region was relatively high, with Sichuan Province having the greatest progress in ecological civilization construction.

Fourthly, in the study of the influencing factors, the effects of the economic factor, environmental regulation, and trade factor on the ecological civilization development in the Yangtze River Economic Belt were not significant, which indicates that economic development had not effectively promoted the ecological civilization development, while the investment factor and urbanization factor had respectively had a positive and negative significant impact on the development of ecological civilization construction in the Yangtze River Economic Belt.

4.2 Recommendation

Based on the above research conclusions and combined with the actual conditions of ecological civilization in China, the following recommendations are proposed:

Firstly, narrow the differences in ecological civilization development within different regions and strengthen the collaborative development of various provinces and cities within each region. Each province and city within the region should vigorously promote resource sharing and the free flow and optimize allocation of production factors. Large enterprises can also implement strategic investment in ecological civilization construction projects across provinces and cities to achieve active cooperation between industries.

Secondly, it is necessary to balance the development of various dimensions reasonably. While promoting economic development, provinces and cities cannot ignore the high-quality distribution and rational utilization of resources and energy, and accelerate the promotion of talent cultivation and technological innovation to achieve green energy conversion. Governments should strictly implement environmental supervision and vigorously promote the promotion of ecological protection ideas.

Thirdly, each region should leverage its advantages and implement a strategy of adapting to local conditions for the development of ecological civilization. The downstream region with talent accumulation and leading economic levels should vigorously develop green technology innovation

and circular economy; the middle and downstream regions are endowed with unique natural resources, and further industrial development and structural adjustment should be implemented on the basis of focusing on protecting the ecological environment and natural resources.

Fourthly, effectively balance the coordinated development of economy and ecology, and establish a complete legal system for ecological protection. Provincial and municipal governments should assist in promoting the construction of rural economic industries, narrowing the economic level gap between rural and urban areas and avoiding the imbalance of economic development and excessive consumption of resources and energy caused by excessive urbanization. The environmental regulation is an important guarantee for achieving stable development of ecological civilization; therefore, governments should implement the construction of ecological protection regulation system to ensure the effectiveness and continuity of policy implementation.

References

[1] Guohua Bi, Qingyuan Yang, Su Liu. Coupling Coordination Development between Ecological Civilization Construction and Urbanization in China. ECONOMIC GEOGRAPHY. Vol.13 (2017) No.1, p.50-58.

[2] Zongbing Deng, Shuwei Zong, Congwen Su, et al. Research on Coupling Coordination Development between Ecological Civilization Construction and New Urbanization and Its Driving Forces in the Yangtze River Economic Zone. ECONOMIC GEOGRAPHY. Vol. 39 (2019) No.10, p.1287-1297.

[3] Edward B, B. The Concept of Sustainable Economic Development. Environmental Conservation. Vol. 14 (1987) No. 2, p.101-110.

[4] Howard, E. To-Morrow: A Peaceful Path to Real Reform. Swan Sonnenschein & Co., Ltd. London. 1898

[5] Cheng Huang, Chuanqing Wu. Research on the Synergetic Effect of Industrial Green Transformation and Ecological Civilization Construction in the Yangtze River Economic Belt. Resources and Environment in the Yangtze Basin. Vol. 30 (2021) No. 6, p.1287-1297.

[6] Xiangcheng Jiang, Xin Zhao. Agricultural Ecological Efficiency and Its Factors Yangtze River Economic Zone. Resources and Industries. Vol.23 (2021) No. 5, p.41-50.

[7] Zhaofeng Wang, Qingfang Liu. Spatio-temporal Evolution and Influencing Factors of Tourism Eco-efficiency in the Yangtze River Economic Belt. Resources and Environment in the Yangtze Basin. Vol.28 (2019) No.10, p.2289-2298.

[8] Yuanzheng Wu, Zhiguang Zhang. Analysis of Influencing Factors in the Construction of Ecological Civilization in China. Cosmography and Humanities (Academic Edition). (2012) No.2, p.386-390.

[9] Lianfu Yan, Jianbin Zhao, Lixia Mao. The Core Connotation, Construction Direction and Realization Path of Xi Jinping's Ecological Civilization Thought. Journal of Northwest A&F University (Social Science Edition). Vol.21 (2021) No.1, p.1-9.

[10] Xixi Zhang, Zhengxu Cao. Spatio-temporal Evolution and Analysis of Influencing Factors of Industrial Ecological Efficiency and in Yangtze River Economic Belt. Resources and Environment in the Yangtze Basin. Vol.31 (2022) No.3, p.493-502.